

REMARKS

The present invention relates to a resin composition having superior melt molding properties, gas barrier properties, flexural fatigue resistance, and impact resistance. The present invention also relates to a multilayered structure, particularly one which has good appearance, good delamination resistance, good transparency, good impact resistance, and good gas barrier properties.

As recited in present Claim 35, one embodiment of the present invention is a resin composition which comprises a copolymer (A) comprising ethylene as a major component produced by using a single-site catalyst, and an ethylene-vinyl alcohol copolymer (B) having an ethylene content of 20 to 60 mol% and a degree of hydrolysis of 95% or above, said resin composition satisfying the following equation (1):

$$1/99 \leq \{\text{weight of (A)}\}/\{\text{weight of (B)}\} \leq 99/1 \quad (1).$$

As detailed in the specification under "Description of the Background", beginning at page 1, second paragraph thereof, ethylene-containing copolymers produced using a single-site catalyst have found many uses in the form of a laminate with ethylene-vinyl alcohol copolymers (EVOH). However, the prior art has never disclosed or suggesting combining these materials such as for use in a layer of a multi-layered structure.

Applicants have discovered that a resin composition comprising the above two types of copolymers produces results not obtainable when the ethylene-containing copolymer is obtained using conventional Ziegler catalysts. Similar results are obtained when a carboxylic acid-modified polyolefin is present as a third component. These results are demonstrated in the specification.

In a first set of comparisons, Comparative Examples 1-1 through 1-7 are described in the specification at pages 41 and 43-44, and employed an ethylene-containing copolymer

made from a Ziegler catalyst. These comparative examples are to be compared to Examples 1-1 through 1-19. The examples and the tests performed on the examples is described in the specification at page 34, third full paragraph, through page 37, line 5. The results are shown in Tables 1 and 2, at pages 46 and 47, respectively of the specification. Compare particularly Examples 1-1, 1-3, and 1-4 with Comparative Examples 1-1, 1-3 and 1-4. Compare particularly Example 1-2 with Comparative Example 1-2. Compare particularly Examples 1-17, 1-18 and 1-19 with Comparative Examples 1-5, 1-6 and 1-7, respectively.

In another group of tests, described in the specification beginning at page 50, second full paragraph, Comparative Examples 2-1 through 2-5, described in the specification at pages 51, 53-54, and 56, (except for Comparative Example 2-1), employed an ethylene-containing copolymer made from a Ziegler catalyst. Examples 2-1 through 2-12 are according to the present invention. The results are shown in Table 3 at page 57 of the specification. Compare particularly Examples 2-1, 2-7 and 2-8 with Comparative Examples 2-3, 2-2 and 2-4, respectively.

As the results in Tables 2 and 3 show, the presently-recited copolymer (A) results in properties improved over the use of ethylene copolymers obtained from conventional Ziegler catalysts.

A copy of Tables 1, 2 and 3 is **attached herewith**.

The above-discussed data could not have been predicted by the applied prior art.

The rejections of Claims 35, 39-41, 44-46 and 48 under 35 U.S.C. §103(a) as unpatentable over EPA 0682072 (EP Negi et al) or U.S. 6,258,464 (US Negi et al), each in view of U.S. 5,026,798 (Canich), are respectfully traversed.

Negi et al¹ disclose a resin composition and multi-layered structure comprising the same comprising, *inter alia*, an ethylene-containing copolymer, such as HDPE. Negi et al neither disclose nor suggest the use of ethylene-containing polymers obtained from single-site catalysts. Indeed, one skilled in the art would interpret Negi et al as drawn to ethylene-containing copolymers obtained from conventional Ziegler catalysts.

Applicants submit that Negi et al is the closest prior art. As discussed above, Applicants have compared to what is, in essence, the closest prior art and obtained results that could not have been predicted thereby.

Recognizing the deficiencies of Negi et al, the Examiner relies on Canich. Canich discloses a catalytic process for making crystalline α -olefin polymers by using, in effect, a single-site catalyst. Significantly, as is now well-known in the art, α -olefin polymers produced using single-site catalysts are significantly different from such polymers produced by conventional Ziegler-Natta catalysts, in terms of, for example, molecular weight, molecular weight distribution, and tacticity control (column 1, lines 23-36; column 6, lines 24-33). Canich adds nothing, since Applicants never professed to have invented crystalline α -olefin polymers obtained by using a single-site catalyst. There is no disclosure in Canich with regard to using their single-site catalyst-prepared α -olefin polymers with other specific materials, let alone the presently-recited ethylene-vinyl alcohol copolymer (B). Why, absent Applicants' disclosure, would one skilled in the art use any of the α -olefin polymers of Canich as the polyolefin (A) component of Negi et al, especially when it is already known

¹EP Negi et al and US Negi et al are from the same patent family, i.e., each derives priority from JP 6-124183. Their disclosures are identical. As will subsequently be established, US Negi et al is not prior art herein. Thus, the term "Negi et al" will be used when referring to the disclosures therein. Citations in the text will be to pages and lines in EP Negi et al. Note finally that Negi et al was cited in the European Search Report as an "A" reference, as technological background only.

that such copolymers have different properties from ones made with the conventional Ziegler-Natta catalyst? Moreover, where is the disclosure or suggestion in Canich that replacing a conventional poly α -olefin with a single-site catalyst-derived poly α -olefin would produce the significantly better results detailed in the comparative data of record discussed above? Where is the disclosure or suggestion in the applied prior art that haze and peel strength, just to cite two exemplified properties, for example, would be improved by employing a single-site catalyst-prepared α -olefin polymer in place of a conventional Ziegler-Natta catalyst-prepared α -olefin polymer in Negi et al? There is no such disclosure or suggestion. Indeed, the Examiner does not say. Rather, the Examiner bases her rationale that there would be "reasonable expectation of obtaining a polyolefin with high molecular weight and a narrow molecular weight distribution based on the teachings of Negi et al and Canich." The Examiner is clearly correct that the reasonable expectation would be such a polyolefin. But the Examiner has not explained why a person skilled in the art practicing Negi et al would want their polyolefin (A) to have these properties of high molecular weight and narrow molecular weight distribution. In other words, the Examiner has not provided the requisite motivation.

In addition, Negi et al's composition is a polyolefin-rich, scrap resin composition disclosed as overcoming flow anomalies such as charring, lip stain and the like (page 2, lines 53-55). Thus, the presently-claimed invention and Negi et al are concerned with different properties. As discussed above, improved flexural fatigue resistance is one of the characteristics of the presently-claimed resin composition. Lack of flexural fatigue resistance is an intrinsic problem of EVOH, and it cannot occur when a polyolefin-rich resin composition, such as that disclosed in Negi et al, is used.

The Examiner asserts that a person skilled in the art would be motivated to combine

Negi et al and Canich to obtain a polyolefin with high molecular weight and narrow molecular weight distribution as well as high strength properties, the latter of which the Examiner analogizes to high impact resistance, one of the properties desired by Negi et al. However, it is clear that the properties of the polyolefin-rich resin composition of Negi et al, particularly the high strength properties, depend on the properties of the polyolefin used. Indeed, polypropylene (PP) and high density polyethylene (HDPE), each known to have high strength properties, are used in the examples of Negi et al. The properties of the resin composition depend upon various elements, such as compatibility of the EVOH and ethylene- α -olefin copolymer. Therefore, even if the polyolefin used has "high strength" properties, the impact resistance of the resin composition is not always improved. In other words, impact resistance of the resin composition does not equate with "high strength" properties of the polyolefin used.

The above is demonstrated by the Declaration under 37 CFR 1.132 of named coinventor Kazuyori Yoshimi (Yoshimi Declaration), filed January 2, 2002 in the parent application, a copy of which is **submitted herewith**. In Experiment 1 of the Yoshimi Declaration, evaluation of properties of a resin composition comprising EVOH and HDPE, as a layer (RC) in a multi-layer specimen was carried out. HDPE has higher strength properties (Ultimate Tensile) than the ethylene- α -olefin copolymer used in Examples 2-12 of the specification herein.

As described in the Yoshimi Declaration, however, the result of the evaluation of the resin composition comprising EVOH and HDPE is not desirable. It indicates that the addition of HDPE to EVOH to form a resin composition thereof cannot improve flexural fatigue resistance and impact resistance over the use of EVOH alone, as described in Comparative Example 2-1 of the specification herein. The results in the Yoshimi Declaration

together with corresponding results in the specification herein are summarized by the table below:

	Polyolefin (ethylene- α -olefin copolymer)	Brand	Ultimate Tensile (ASTM D-638)
Experiment 1 (EVOH and HDPE)	HDPE	Mitsui Chemicals, Inc. "HI-ZEX 8200B"	40 MPa
Example 2-12 (EVOH and ethylene- α -olefin copolymer)	ethylene- α -octene copolymer	Dow Plastics "Engage EG8100"	10.3 MPa
Comparative Example 2-1 (EVOH only)	None	-	-

(Catalog pages for Mitsui Chemicals, Inc. "HI-ZEX 8200B" (and a verification of English translation thereof) and Dow Plastics "Engage EG8100", both of which were filed in the parent application, are **submitted herewith**.)

	Occurrence of pinholes (times)	Breaking drop height (m)
Experiment 1	500	1.1
Example 2-12	2500	2.0
Comparative Example 2-1	500	1.2

In addition to the above, and in response to the requirement in paragraph 14 of the Office Action, Applicants represent, through undersigned counsel, that the subject matter disclosed in US Negi et al, and the presently-claimed invention were, at the time the presently-claimed invention was made, commonly owned.

For all the above reasons, it is respectfully requested that the rejections over Negi et al in view of Canich be withdrawn.

The rejections under the judicially created doctrine of obviousness-type double patenting of Claims 35, 40, 44, 45, and 46 over Claim 1 of US Negi et al in view of Canich, and of Claim 48 over Claim 1 of US Negi et al in view of Canich and EP Negi et al, are respectfully traversed. Everything that has been stated above with regard to the prior art rejections over Negi et al in view of Canich apply herein as well. Accordingly, it is respectfully requested that these rejections be withdrawn.

Regarding paragraph 13 of the Office Action, Applicants respectfully disagree with the Examiner's finding that Claims 46 and 48 are directed to an invention not patentably distinct from Claim 1 of US Negi et al, for reasons discussed above in connection with the prior art rejections over Negi et al.

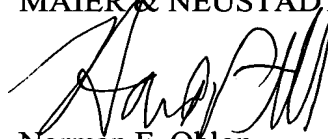
The rejections under the judicially created doctrine of obviousness-type double patenting of Claims 35-36, 38-39 and 43 over Claims 1-3 and 6 of U.S. 6,388,007 (Nakatsukasa, et al), and of Claim 44 over Claims 1-3 of Nakatsukasa et al in view of EP Negi et al, are respectfully traversed. Nakatsukasa et al is the patented parent application. **Submitted herewith** is a terminal disclaimer over Nakatsukasa et al. Accordingly, it is respectfully requested that these rejections be withdrawn.

Applicants gratefully acknowledge the Examiner's allowance of Claims 21-34, and the indication of allowability of Claims 37, 42 and 47. Nevertheless, Applicants respectfully submit that all of the presently pending claims in this application are in immediate condition

for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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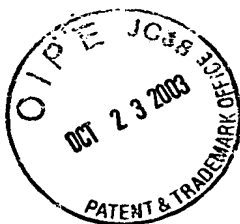


Table 1

	Ethylene- α -olefin copolymer (A)					EVOH (B)					Modified PO (C)		Addi- tive	Note
	Density	Mw/Mn	MFR g/10 min	Amount mol%	Ethylene Ppm	P ppm	Na ppm	MFR g/10 min	Amount pbw	Resin	Amount pbw			
Example 1-1	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PE	5	--		
Example 1-2	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PE	5	-	*1	
Example 1-3	0.910	3.3	3.5	80	32	100	65	3.1	20	Modified PE	5	-		
Example 1-4	0.935	3.8	2.5	80	32	100	65	3.1	20	Modified PE	5	-		
Example 1-5	0.915	3.6	1.0	80	27	100	65	3.9	20	Modified PE	5	-		
Example 1-6	0.915	3.6	1.0	80	44	100	65	3.5	20	Modified PE	5	-		
Example 1-7	0.915	3.6	1.0	80	32	0	65	3.1	20	Modified PE	5	-		
Example 1-8	0.915	3.6	1.0	80	32	100	3	3.1	20	Modified PE	5	-		
Example 1-9	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PP	5	-		
Example 1-10	0.913	3.7	30	80	32	100	65	3.1	20	Modified PE	5	-		
Example 1-11	0.915	3.6	1.0	80	32	100	65	33	20	Modified PE	5	-		
Example 1-12	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PE	5	D		
Example 1-13	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PE	5	D	*2	
Example 1-14	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PE	5	E		
Example 1-15	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PE	5	D+E		
Example 1-16	0.895	3.6	1.6	80	32	100	65	3.1	20	Modified PE	5			
Example 1-17	0.915	3.6	1.0	80	32	100	65	3.1	20	-	-			
Example 1-18	0.915	3.6	1.0	50	32	100	65	3.1	50	Modified PE	5			
Example 1-19	0.915	3.6	1.0	80	32	100	65	3.1	20	Modified PE	30			
Comparative Example 1-1	0.925	7.5	0.8	80	32	100	65	3.1	20	Modified PE	5	-		
Comparative Example 1-2	0.925	7.5	0.8	80	32	100	65	3.1	20	Modified PE	5	-	*1	
Comparative Example 1-3	0.953	6.8	1.0	80	32	100	65	3.1	20	Modified PE	5	-		
Comparative Example 1-4	0.89	4.6	3.0	80	32	100	65	3.1	20	Modified PE	5	-		
Comparative Example 1-5	0.925	7.5	0.8	80	32	100	65	3.1	20	-	-	-		
Comparative Example 1-6	0.925	7.5	0.8	50	32	100	65	3.1	50	Modified PE	5	-		
Comparative Example 1-7	0.925	7.5	0.8	80	32	100	65	3.1	20	Modified PE	30	-		

*1 Regrinds, *2 Blended pellets.

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Table 2

	Characteristics of sheet				Characteristics of thermoformed articles	
	Appearance		Dia. Of dis- persed particles (μm)	Haze (%)	Dropping height (m)	Peel strength kg/15 mm width
	30 min later	6 hours later				
Example 1-1	A	B	1.5	35	1.7	2.0
Example 1-2	B	B	1.7	39	1.6	1.8
Example 1-3	A	B	1.4	30	2.0	2.1
Example 1-4	A	B	1.6	41	1.6	1.8
Example 1-5	A	B	1.6	37	1.6	1.7
Example 1-6	A	B	1.7	33	1.8	2.2
Example 1-7	A	C	1.6	39	1.6	2.0
Example 1-8	B	B	1.7	40	1.5	1.4
Example 1-9	B	B	1.9	45	1.4	1.6
Example 1-10	B	B	2.5	51	1.3	1.6
Example 1-11	B	B	2.3	49	1.4	1.7
Example 1-12	A	A	1.4	43	1.8	2.1
Example 1-13	A	A	1.5	46	1.9	2.2
Example 1-14	A	A	1.5	33	1.7	2.1
Example 1-15	A	A	1.3	46	1.8	2.3
Example 1-16	B	B	1.6	22	2.3	2.2
Example 1-17	C	D	3.2	70	0.9	0.6
Example 1-18	B	C	1.7	47	1.1	1.5
Example 1-19	C	D	1.8	40	1.3	2.3
Comparative Example 1-1	A	B	1.6	54	1.4	1.4
Comparative Example 1-2	B	B	1.8	60	1.3	1.2
Comparative Example 1-3	B	B	1.9	68	1.1	0.8
Comparative Example 1-4	B	C	2.0	31	2.0	1.6
Comparative Example 1-5	D	D	4.1	82	0.6	0.4
Comparative Example 1-6	C	C	2.2	56	0.8	1.1
Comparative Example 1-7	D	D	2.5	49	1.1	2.0

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Table 3

	Ethylene- α -olefin copolymer (A)						EVOH (B)		Modified PE (C)	Dispersed particle (μ m)	Oxygen permeability ml/m ² ·day·atm	Occurrence of pinholes (times)	Breaking drop height (m)
	Density	Mw/Mn	MI g/10 min.	Amount pbw	Ethylene content, mol%	MI g/10 min	Amount pbw	Amount pbw					
Comparative Example 2-1	-	-	-	0	32	3.1	100	0	-	-	0.4	500	1.2
Example 2-2	0.87	3.7	1.0	5	32	3.1	95	5	1.5	1.5	0.5	7000	2.6
Example 2-1	0.87	3.7	1.0	10	32	3.1	90	5	1.6	1.6	0.5	8500	3.2
Example 2-3	0.87	3.7	1.0	20	32	3.1	80	5	1.6	1.6	0.7	10000	3.3
Example 2-4	0.87	3.7	1.0	50	32	3.1	50	5	(*)	(*)	30	10000	3.5
Example 2-5	0.87	3.7	1.0	10	27	3.9	90	5	1.7	1.7	0.4	7500	2.8
Example 2-6	0.87	3.7	1.0	10	44	3.5	90	5	1.5	1.5	1.7	10000	3.4
Example 2-7	0.885	3.4	1.0	10	32	3.1	90	5	1.5	1.5	0.5	7000	2.8
Comparative Example 2-2	0.89	4.6	3.0	10	32	3.1	90	5	1.9	1.9	0.6	4500	2.3
Comparative Example 2-3	0.87	4.3	0.9	10	32	3.1	90	5	1.8	1.8	0.6	4000	2.2
Example 2-8	0.915	3.6	1.0	10	32	3.1	90	5	1.7	1.7	0.5	1500	1.6
Comparative Example 2-4	0.925	7.5	0.8	10	32	3.1	90	5	2.0	2.0	0.7	1000	1.4
Example 2-9	0.87	3.7	1.0	10	32	3.3	90	5	3.2	3.2	1.0	5000	1.8
Example 2-10	0.885	3.5	30	10	32	1.3	90	5	3.1	3.1	0.9	5500	2.1
Example 2-11	0.87	3.7	1.0	10	32	3.1	90	5	1.8	1.8	0.6	7000	3.0
Example 2-12	0.87	3.7	1.0	10	32	3.1	90	0	2.0	2.0	0.8	2500	2.0
Comparative Example 2-5	0.89	4.6	3.0	10	32	3.1	90	0	2.7	2.7	1.2	1000	1.4

*1 The compounded resins dispersed in a reticulate state.

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